**National Aeronautics and
Space Administration**

**Software Independent Verification & Validation Facility
Fairmont, WV 26554**

Office of Safety and Mission Assurance (OSMA) Software Assurance Research Program

Operating Plan (FY03) - Abridged[1]

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17 September 2002

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[1] A list of proposals not selected for award was deleted.

OSMA

Office of Safety and Mission Assurance

SARP

Software Assurance Research Program

Operating Plan (FY03) - Abridged

Submitted By:

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1.0 INTRODUCTION

The NASA IV&V Facility manages a Software Assurance Research Program (SARP) that is funded by NASA Code Q/Office of Safety and Mission Assurance (OSMA). The NASA Centers and their contractors, West Virginia University (WVU), other universities, and the IV&V Facility conduct research initiatives under the SARP.

The primary goal of this research program is to provide NASA with the software assurance practices, methods, and tools needed to produce safe and reliable software. This program is designed to address fundamental software assurance problems in the field of software engineering primarily as it relates to software safety, quality, independent verification and validation (IV&V), testability, and reliability. It is intended to develop and transfer to NASA projects, software assurance practices, methods and tools to improve the quality of the software produced by and for NASA, and to assist NASA in becoming a leader in the development of safe and reliable, cost effective software. This document is an operating plan that the Centers and their contractors, WVU, and the IV&V Facility will follow to achieve the goals of the NASA SARP.

The OSMA Deputy Associate Administrator oversees the SARP through a Delegated Program Manager (DPM). The DPM is responsible for the total management of the OSMA SARP to include: establishing research objectives, evaluation and selection of proposals, financial management, and evaluation of research deliverables. DPM delegation for FY03 is pending.

1.1.   Purpose of This Document

The purpose of this document is to provide the Office of Safety and Mission Assurance (OSMA) with a comprehensive SARP Operating Plan for FY03. Approval of this Operating Plan by the Deputy Associate Administrator for OSMA assigns authority for functional and technical management of the OSMA SARP to the NASA IV&V Facility.

1.2.   Reference Documents

Table 1-1: Reference Documents

Document Number	Document Title
N/A	The NASA IV&V Facility Program Plan of June 2001

Document Number	Document Title
N/A	The OSMA Software Assurance Program Research Program (SARP) Level I Technical Program Plan (FY03-FY05) February 15, 2002
SARP-NRA-0201	NASA Research Announcement Software Assurance Research
N/A	Software Assurance Research Initiative Proposal Evaluation Plan
IVV 09-3	OSMA SARP
IVV 09-3-1	Process Verification
IVV 09-6	Management and Performance of Research
IVV 09-6-1	Work Instruction for the Publication/Presentation of Research Results

1.2.1. Program Plan

The NASA IV&V Facility Program Plan, June 2001, Section 7 – IV&V Research Plan, defines the goal of the IV&V Facility research program and the Facility's role in the program. It also describes:

- Center Initiatives
  - Dissemination of Call for Proposals, including the OSMA SARP Level I Technical Program Plan
  - Topics of Research
  - Proposal Selection Process
  - Evaluation Criteria
  - Evaluators
  - Evaluation Process
  - Final Proposal Selection
- West Virginia University Research
- Research Monitoring
- Anticipated Future Center Initiative Research
- Strengthening Research Opportunities
  - Research Proposal Planning
  - Conference Directory

The NASA IV&V Facility Program Plan, Section 8.2 - Software Tool Evaluation, describes a Facility proposal to create a tool repository and a database of information on the tools. This repository and database will include all tools used at the Facility. All research initiative deliverables including tools and other executable software as well as research papers and

progress reports, are stored in the NASA IV&V Facility Center Initiative Management Tool (CIM Tool). In FY03, the IV&V Facility will activate an SARP Results website. The website will make available research initiative deliverables that are worth disseminating and that have been authorized by NASA for access. The purpose of the SARP Results website is to help software development projects select the optimal tools for their application and environment.

1.2.2. OSMA SARP Level I Technical Program Plan

The Level I Technical Program Plan provides a program overview; participant authority, roles and responsibilities; proposal handling procedures; and resource projections.

The program overview includes program purpose, background, goal and objectives, implementation strategy, proposal evaluation criteria, proposal categories and program authority designation.

Authority, roles and responsibilities are described for
- The Deputy Administrator for OSMA
- The OSMA SARP Delegated Program Manager
- Goddard Space Flight Center
- The OSMA SARP proposal Selection Committee
- NASA's strategic enterprises
- OSMA
- The IV&V Facility
- The NASA Software Working Group (SWG)
- NASA centers
- Universities and industry
- Principle investigators (NASA, university and industry)

1.2.3. International Organization for Standardization (ISO) Procedures and Work Instructions

IVV 09-3 is the IV&V Facility's ISO 9001 standard procedure for defining and managing the OSMA SARP.

IVV 09-3-1 is the Facility's ISO 9001 standard procedure for establishing a consistent method for reviewing the software assurance activities of NASA Center mission and safety critical software projects (or program) as part of an OSMA Process Verification (PV) review.

IVV 09-6 is the Facility's ISO 9001 standard procedure for establishing a consistent and documented method for the management and performance of all research by or under contract with the Facility.

IVV 09-6-1 defines the activities performed by responsible individuals involved in publication and presentation of research results.

This operating plan conforms to these procedures and work instructions.

2.0 OSMA FY03 SARP IMPLEMENTATION PLAN

The OSMA FY03 SARP implementation strategy is to conduct:

a) Applied software assurance research through NASA Center Initiatives (CI),

b) Applied software assurance research through university grants and industry contracts,

c) Theoretical and applied software assurance research through West Virginia University Initiatives,

d) Technical analyses of initiative deliverables with support from IV&V Facility contractors to ensure that quality research is being done.

2.1. Annual Cycle

The OSMA SARP follows an annual cycle of key activities. The key activities and corresponding dates for FY03 are as follows:

Table 2-1: OSMA SARP Key Activities and Dates

Activity	Date
• Release Level I plan	February 13, 2002
• Issue POP call	March 20, 2002
• Issue NRA	April 24, 2002
• Receive proposals	June 21, 2002
• Select for award	August 28, 2002
• Release Level II plan	September 23, 2002
• Award contracts	January 2, 2003
• Conduct Symposium	July 30-August 1, 2003

ID	Task Name	Dec	1st Quarter Jan Feb Mar	2nd Quarter Apr May Jun	3rd Quarter Jul Aug Sep	4th Quarter Oct Nov Dec	1st Quarter Jan Feb Mar	2nd Quarter Apr May Jun	3rd Quarter Jul Aug Sep	4th Quarter Oct Nov Dec	1st Quarter Jan Feb Mar
1	Release Level I plan		2/13								
2	Issue POP call		3/1								
3	Issue NRA			4/24							
4	Receive proposals			6/21							
5	Select for award				8/28						
6	Release Level II plan				9/23						
7	Award contracts					1/2					
8	Conduct Symposium								▮		

2.2. Theoretical & Applied Research: Center Initiatives, University Grants, Industry Contracts

Following is a summary of the results of the FY03 proposal solicitation, evaluation and selection process and the approach that the IV&V Facility will employee to manage the FY03 research initiatives.

2.2.1. Solicitation

The OSMA SARP used the Level I Technical Program Plan to solicit participation by NASA Center personnel and their contractors. To solicit proposals from universities and industrial organizations, the OSMA SARP used a NASA Research Announcement (NRA). For WVU proposals, the NASA IV&V Facility Research Lead identifies current research needs to the WVU Research Chair and the WVU Research Chair provides WVU research proposals to the NASA IV&V Facility Research Lead.

The Level I Technical Program Plan and the NRA contained identical statements of program background, goal, objectives, implementation strategy, evaluation criteria and proposal categories. Stated resource projections were different. The Level I plan stated that approximately $4.6 M was projected for the total OSMA SARP program while the NRA stated that an order of magnitude estimate of the funds to be available for NRA awards was $1 M.

In February 2002, the IV&V Facility submitted a Level 1 Technical Program Plan to Code Q/OSMA. Code Q provided an Operating Plan that included the IV&V Facility Level 1 Technical Program plan to Code B. Code B incorporated the Code Q Operating Plan into the Program Operating Plan (POP) call. In March 2002, Code B issued the POP call to the Centers inviting them to submit proposals for FY03 funding.

On April 24, 2002, GSFC procurement issued a synopsis of the NASA Research Announcement for Software Assurance Research (NRA SARP 0201). The NRA was also posted on the web site: http://www.ivv.nasa.gov/business/research/index.shtml.

The web site, http://www.ivv.nasa.gov/business/research/index.shtml was established to provide guidance to submitters. The web site included links to the Level I Technical

Program Plan and the NRA, a template for Center software initiative proposal format, an evaluation plan, a list of the evaluation criteria, and frequently asked questions and answers.

2.2.2. Evaluation

In response to the POP call and the NRA, one-hundred fifteen proposals were submitted and reviewed. Requests for FY03 funding totaled $15,855,309.

On average, each proposal received 4-5 evaluations. A total of 539 evaluations were completed.

2.2.2.1. Software Working Group Evaluators

The Software Working Group (SWG) provided evaluations of the proposals. Each of the ten NASA Centers has representation on the SWG. The Centers' SWG members or their designees performed the Center evaluations. To ensure that all proposals received at least 3 evaluations, the IV&V Facility Research Lead, through the IV&V support contractor, requested each SWG members to evaluate 23 specific proposals. He assigned a different set of 23 to each SWG member. For the larger Centers, he also requested them to evaluate at least 17 others of their choice. For the smaller Centers, Stennis and Dryden, he requested them to evaluate at least 5 others of their choice. He requested NASA Headquarters SWG members to evaluate at least 10 proposals of their choice.

2.2.2.2. Evaluation Criteria

Eight evaluation criteria were applied. The evaluation criteria are:

1. Potential contribution to mission success
2. Potential contribution to mission assurance
3. Relevance to IV&V, reliability and safety
4. Relevance to existing or planned NASA programs and projects
5. Potential for technology transfer to other NASA or industry programs and projects
6. Uniqueness of the research
7. Clarity of objectives, methodology, and success criteria
8. Competency/experience of the researcher

2.2.2.3. Proposal Categories and Weighting Factors

Proposals were solicited for initiatives in three categories – new, renewed, and transition.

- For new initiative proposals, the uniqueness of the proposed research, potential benefit to NASA, and past researcher performance and competence was considered more heavily than the other evaluation criteria.

- For renewed initiatives, the potential contribution to mission success and mission assurance was considered more heavily than the other evaluation criteria.

- For transition initiative proposals, the potential for technology transfer and contribution to mission success was considered most heavily.

2.2.2.4. Automated Tool Support

The IV&V Facility support contractor provided an automated tool that functioned as the repository for proposal evaluations. The contractor also provided automated tools that, for each proposal
- Compiled evaluator scores for each criterion
- Computed grand average score
- Computed weighted grand average score
- Computed standard deviation of weighted total scores.

For all proposals, the automated tools also
- Ranked proposals in each category
- Reported scores, ranking, standard deviation, and proposed cost as well as proposal identification information to selection committee.

2.2.2.5. Selection Committee Process

The Selection Committee evaluated all the proposals, reviewed the SWG evaluation results and selected proposals for award. After evaluating all the proposals and after reviewing the SWG evaluations, Linda Rosenberg, Ken McGill, and Martha Wetherholt, reconciled the evaluations, ranked the proposals, and selected the top ranked proposals that could be supported within fiscal year funding limits. (Martha Wetherholt supports the OSMA Deputy Associate Administrator and is a Code Q representative on the evaluation committee.) Once the final decisions were made about which proposals would be recommended for funding, the results were written into this document. , below, summarizes the funding requested for the Centers, universities, industrial organizations, WVU, and the IV&V Facility.   is the list of proposals that are recommended for funding. Table A-1 (attached) is the list of proposals not recommended for funding.

Of the proposals that the selection committee selected, 7 were proposals to the NRA. Four of those selected proposals were from universities: Arizona, Alabama, Alabama A&M, and Portland State. See , below, for a breakout of NRA proposals. The IV&V Facility will work with GSFC procurement to award grants for those selections. Three of the selected NRA proposals were from industry: Mountain State Information Systems, Triakis, and Valimetrics. The IV&V Facility will work with GSFC procurement to awards contracts to

Mountain State Information Systems and Triakis. The Valimetrics proposal identified Ames Research Center as their point of contact. Ames will award a contract for the accepted Valimetrics proposal. Once funding has been approved and agreements executed, the FY03 research initiatives will be managed as described in the following section.

Table 2-2: Grants and Contracts from NRA Proposals

Proposal #	Award Type	Proposer	Proposal Title	FY03 Cost
51	Grant	Arizona State University	Timing and Race Condition Verification of Real-time Systems	$ 125,164
72	Contract	Mountain State Information Systems	Completing the Loop: Linking Software Features to Failures	$ 105,000
37	Grant	University of Alabama	Semantic Metrics for Object-Oriented Design	$ 104,964
70	Contract	Triakis	The Use of a Virtual System Simulator & Executable Specifications	$ 90,000
50	Grant	Portland State University	Optimizing IV&V Benefits Using Simulation	$ 80,000
112	Grant	Alabama A&M University	R&D Required to Estimate Modeling & Simulation Verification, Validation & Accreditation	$ 55,000
49	Contract	Valimetrics, LLC	Runtime Continuous Verification of an Onboard Planner	$ 101,379

2.2.3.   Research Initiative Management

The IV&V Facility will manage the execution of research initiatives. The Facility will

- Track research initiative status;

- Review deliverables;

- Conduct formal quarterly reviews of each research initiative;

- Provide technical and program direction;

- Disseminate appropriate research initiative deliverables through the SARP Results website;

- Conduct an annual symposium to disseminate the research initiative results.

2.2.3.1. Track Research Initiative Status

Once funded research on a research initiative officially begins, the IV&V Facility Advanced System and Software Engineering Technologies (ASSET) support contractor will frequently monitor actual research initiative deliverables and apprise the IV&V Facility Research Lead of late submittals.

The ASSET contractor maintains the IV&V Facility Center Initiative Management (CIM) Tool. The CIM Tool provides end-to-end research project management support. The CIM Tool is a web-based knowledge management tool. The IV&V Facility Research Lead, the IV&V Facility Research Chair, the OSMA SARP Principal Investigators and the ASSET contractor all use the CIM tool. Starting with proposals, the ASSET contractor uploads PI proposals into the CIM tool. Proposal evaluators use the CIM tool to evaluate proposals. Once NASA awards center initiatives, grants or contracts, PIs upload their deliverables into the CIM Tool. The ASSET contractor, the IV&V Facility Research Lead and the IV&V Facility Research Chair use the CIM Tool to conduct research initiative reviews.

2.2.3.2. Review Deliverables

The ASSET support contractor will perform a cursory review of each research initiative deliverable to determine if the deliverable conforms to the research initiative proposal. The ASSET support contractor will recommend acceptance, rejection, or formal evaluation. The NASA IV&V Facility Research Lead will review the deliverable and decide whether to accept it, reject it or have a formal evaluation performed. If the NASA IV&V Facility Research Lead or the NASA Civil Servant research project manager decides to have a formal evaluation performed, he will select appropriate subject matter expert(s) to perform the evaluation. Contractor and government deliverable review evaluation results and decisions will all be documented in the Web-based CI Management (CIM) tool.

2.2.3.3. Quarterly Reviews

The IV&V Facility Research Lead will hold quarterly teleconferences with the principle investigator for each research initiative. Upon receipt of a research initiative deliverable, the Research Lead will review it in accordance with IV&V ISO Procedures. The Research Lead and subject matter experts will also review research initiative progress, activities, accomplishments and deliverables on a quarterly basis. The Research Lead may conduct "site visits" which include, but are not limited to, attending status briefings, demonstrations and product reviews, enhancing customer relations, and ensuring program penetration.

2.2.3.4. Technical and Program Direction

The IV&V Facility Research Lead will provide technical and program direction to research initiative principal investigators as a result of informal and formal research initiative reviews and program developments.

2.2.3.5. Results Website

Appropriate research initiative deliverables will be disseminated through the IV&V Facility OSMA SARP Results website. All research initiative deliverables are stored in the NASA IV&V Facility Center Initiative Management Tool (CIM Tool). Research initiative deliverables include executable software as well as research papers and progress reports. In FY03, the IV&V Facility will activate a OSMA SARP Results website. The website will make available research initiative deliverables that are worth disseminating and that have been authorized by NASA for access. The purpose of the SARP Results website is to help software development projects select the optimal information and tools for their application and environment.

2.2.3.6. Symposium

The IV&V Facility Research Lead conducts an annual NASA OSMA Software Assurance Symposium (SAS). The SAS brings together practitioners and theorists in the field of software assurance research. This conference facilitates researcher's interactions and the communication of their results. Those in attendance include but are not limited to the research initiative principal investigators, other researchers and individuals involved in the OSMA SARP. SAS 03 will be scheduled for July 30 – August 1, 2003.

2.3. Theoretical and Applied Research - West Virginia University Initiatives

The WVU software assurance research program will be linked to the software assurance research currently being done and proposed within the NASA Centers. In order to effectively manage the software assurance research being done at WVU under the cooperative agreement, the IV&V Facility will accept proposals from WVU in the form of University Software Initiative Proposals (USIPs), similar to the concept of a NASA CSIP. While the intended focus of the CSIP research is *applied*, the focus of the WVU USIP research can be either applied or *theoretical*. In either case, USIP research is expected to complement the CSIP research. The IV&V Facility shall select the USIPs to be funded with approval of the DPM.

WVU USIPs are due by September 22, 2002.

2.4.   Technical Analyses

The IV&V Facility in collaboration with WVU performs technical and systems engineering assessments of the research initiatives for the OSMA SARP. This is done to ensure that the research being funded is of the best quality. Assessments are made primarily of the research deliverables, the products of the research. In addition to WVU, the IV&V Facility will use the expertise of the Advanced System and Software Engineering Technologies (ASSET) contractors to facilitate the technical analyses required to evaluate the research. The roles and responsibilities are described in the following section.

3.0   ROLES AND RESPONSIBILITIES

This section defines the roles and responsibilities of the IV&V Facility, its contracting support for technical and systems engineering assessments, the cooperating researchers of West Virginia University and the NASA Centers.

3.1.   OSMA Delegated Program Manager (DPM)

The DPM is responsible for the management of the OSMA SARP, which includes, but is not limited to, the following:

a)   Ensure each research initiative meets the objectives of the OSMA SARP;

b)   Ensure each research initiative adheres to OSMA's and the IV&V Facility's goals and objectives of providing advanced software assurance methods and techniques for all of NASA's software approaches and technologies;

c)   Evaluate the technical sufficiency of each research initiative in meeting current and future NASA software assurance, development, and management needs (Reference: OSMA Software Assurance Program Level 1 Technical Program Plan for FY03 - FY05);

d)   Ensure technical management and financial review of research initiative deliverables and progress;

e)   Disseminate information relating to research initiative activities, accomplishments and products to NASA Centers via web-based technologies;

f)   Act as final authority for the selection, and, if necessary, the termination of research initiatives; and,

g)   Resolve SARP related issues requiring headquarters level intervention.

3.2. The IV&V Facility Research Lead

The Research Lead is responsible for the day-to-day management of the SARP. Duties include:

a)   Final approval of research deliverables,

b)   Approval of changes in research deliverable schedules and funding levels as well as minor changes in scope,

c)   Oversight of WVU and contractor activities,

d)   Resolution of contractual issues,

e)   Conduct of research Program Management Reviews (PMRs),

f)   Managing the Software Assurance Symposium,

g)   Monitoring the SARP budget.

3.3. WVU Research Chair

WVU shall assign a Research Chair to support collaboration with the IV&V Facility. The Research Chair shall:

a)   Work with IV&V personnel and NASA personnel to identify critical areas in which software assurance research is needed. Provide the IV&V Facility with a list of recommended research topics and a description of the recommended research for each topic. Provide the IV&V Facility with proposals for those research topics that WVU will pursue.

b)   Review and recommend disposition of research initiatives and WVU software assurance research deliverables.

c)   Track progress of each research initiative and WVU software assurance research efforts.

d)   Facilitate communication between NASA projects and SARP principal investigators from the Centers and from WVU ensuring that software assurance research is applicable to NASA projects and that project data are available to support software assurance research.

e)   Ensure the quality of WVU software assurance research and the transition of WVU software assurance research results into NASA projects as appropriate.

f) Obtain final government approval from the IV&V Facility Research Lead in all recommendations.

g) Be an active teaching professor on the WVU faculty.

h) Serve as the conduit between the SARP and WVU including both professor and student researchers.

3.4. ASSET Support Contract

The purpose of the ASSET contract is to ensure the viability and effectiveness of the research being done through the IV&V Facility as part of the OSMA SARP. The ASSET contractor:

a) Maintains a data repository, known as the CIM tool, to track the status of research initiative deliverables and products, milestones, research focus, and relevant Center and funding information. The ASSET contractor:

   - Ensures the accuracy of data contained in the CIM tool

   - Updates the data contents of the CIM tool

   - Maintains and updates associated support documentation of the CIM tool

   - Allows external internet access to select research deliverables

   - Support WVU and Government review of research status and deliverables

b) Implements, updates and maintains the research initiative evaluation tracking database, which is part of the web-based CIM tool, which tracks for each proposal: the receipt date, point of contact data, reviewers and reviewer scores. The ASSET contractor also performs a statistical analysis on evaluation scores to support selection of research projects from the proposals. The web-based CIM tool facilitates the evaluation process by allowing evaluators to access the proposals and perform the evaluations on-line. The statistical reports for the evaluations of the proposals are updated in real-time as the evaluations are performed.

c) Using the CIM Tool, tracks the progress of each research effort against the proposed schedule, budget, and objectives.

d) Performs a cursory evaluation of each deliverable to determine if it tracks with the researcher's proposal.

e) Provides subject matter experts as requested by the IV&V Facility Research Lead to review deliverables when no in-house government or WVU expertise is available.

f) Provides support for organized visits of representatives primarily from industry and universities via a Visiting Scientist Program, to support work under this contract for

varying periods ranging from one day to several months. The purpose of the Visiting Scientist Program is to promote technical interchange with academia, other government laboratories and the U.S. aerospace industry. The Visiting Scientist Program will enhance the government's understanding of system and software engineering technologies for software assurance and will provide a mechanism for technology transfer of industry and academia expertise to the NASA business enterprises and vice versa.

g) Organizes and runs the annual Software Assurance Symposium

h) Participates in developing, updating and technically editing the following items:

Table 3-1: ASSET Supported Items

Item	Description	Frequency
OSMA Level I Technical Program Plan	Describes the OSMA SARP needs for the next three fiscal years	Once a year
OSMA Level II Plan - Annual Operating Plan	Describes software assurance research to advance the state-of-the-art of software engineering research for practical application within NASA field programs that ultimately improve software safety, quality, and reliability	Once a year
Facility Research Initiative Web Site Contents	SARP related information posted to web pages on the IV&V Facility web site	Update at least monthly

3.5.   Researchers

Researchers in the OSMA SARP include both NASA civil servants and private sector individuals. This document distinguishes between private sector researchers employed by universities or industry. All researchers are responsible for submitting their deliverables according to the schedule in this plan. NASA Center researchers are also responsible for ensuring that their deliverables have been approved for public release when applicable. Private sector individuals are responsible for ensuring that they comply with the terms and conditions of their grant or contract, especially as it pertains to export control. All researchers are also expected to present their findings in an OSMA Software Assurance Symposium to be scheduled each Summer as described above.

4.0   REQUEST FOR FUNDING

 provides a summary of requested FY03 funding. The table includes the requested funding for research (by Center); the recommended funding of university initiative research to be coordinated with West Virginia University; the IV&V Facility contracting support for technical analyses and systems engineering assessments for the OSMA Software Assurance Program (ASSET), and IV&V Operating and Maintenance cost.

Table 4-1: FY03 Summary of Requested Funding

	FY03 Cost
Center Initiatives	**$ 3,434,079**
Ames Research Center	$ 193,379
Glenn Research Center	$ 325,000
Goddard Space Flight Center	$ 805,000
NASA Headquarters	$ 180,000
Jet Propulsion Laboratory	$ 800,000
Johnson Space Center	$ 8,000
IV&V Facility	$ 1,122,700
University Initiatives	**$ 550,000**
WVU/IV&V (Task ID # 400)	$ 550,000
Contracted Technical Support for OSMA SARP	**$ 365,000**
ASSET contract (Task ID # 402)	$ 365,000
IV&V Facility Support Costs	**$ 245,524**
IV&V Intern Program	**$ 100,000**
Total:	**$ 4,694,603**

Table 4-2 identifies the breakdown of competitively selected FY03 proposals recommended for funding as CIs, grants, or contracts by the IV&V Facility.

The proposals that were classified as renewed or transition are continuations of past year funded initiatives. These initiatives had OSMA Operating Plan Task Identification Numbers assigned to them. The first column of table 4-2 contains the OSMA Operating Plan Task Identification Numbers of proposals recommended for funding that are continuations of past year initiatives.

Table 4-2: FY03 Approved Proposals

OSMA Op Plan Task ID#	Proposal #	Proposal Title	FY03 Cost
		Ames Research Center	**$ 193,379**
572	49	Runtime Continuous Verification of an Onboard Planner	$ 101,379
573	105	Transitioning from Software Requirements Models to Design Models	$ 92,000
		Glenn Research Center	**$ 325,000**
443	13	Analysis & Test of Real-Time Linux Operation Systems	$ 95,000
403	14	Injecting Faults for Software Error Evaluation	$ 55,000
442	24	Software Assurance of Web Based Applications	$ 70,000
444	12	Software Safety Assurance of Programmable Logic	$ 105,000
		Goddard Space Flight Center	**$ 805,000**
448	94	Fault Tree Analysis Application for Safety and Reliability	$ 65,000
574	75	Formal Approaches to Swarm Technologies	$ 125,000
575	87	Improving the Agency's Software Acquisition Capability	$ 110,000
576	92	Non-Parametric Software Reliability	$ 80,000
577	89	Software Requirements Analysis as Fault Predictor	$ 60,000
408	46	State-of-the-Art Software Inspections and Reading at NASA	$ 160,000
407	95	System and Software Reliability	$ 120,000
406	93	Use Case Quality Attributes	$ 85,000
		NASA Headquarters	**$ 180,000**
409	103	Integrating Software Into Probabilistic Risk Assessment	$ 180,000
		IV&V Facility	**$ 1,122,700**
452	55	A Spectrum of IV&V Modeling Techniques	$ 100,000
395	21	Automated Testing & Quantitative Evaluation of Real-Time System Source Code	$ 139,972
578	72	Completing the Loop: Linking Software Features to Failures	$ 105,000
456	54	IV&V Cost Estimation–Joint NASA & Navy Collaboration to Model & Automate the Process	$ 128,000
579	52	IV&V Techniques for Object Oriented Software Systems	$ 110,000
580	50	Optimizing IV&V Benefits Using Simulation	$ 80,000
581	112	R&D Required to Estimate Modeling & Simulation	$ 55,000

OSMA Op Plan Task ID#	Proposal #	Proposal Title	FY03 Cost
		Verification, Validation & Accreditation	
453	59	Robust Requirements Tracing via Internet Search Tech: Improving an IV&V Technique	$ 84,600
582	37	Semantic Metrics for Object-Oriented Design	$ 104,964
583	70	The Use of a Virtual System Simulator & Executable Specifications	$ 90,000
584	51	Timing and Race Condition Verification of Real-time Systems	$ 125,164
		Jet Propulsion Laboratory	**$ 800,000**
585	2	Adapting ODC for Empirical Evaluation of Pre-Launch Anomalies	$ 220,000
410	44	Infusing Software Fault Measurement and Modeling Techniques	$ 205,000
53	6	Reducing Software Security Risk Through An Integrated Approach	$ 250,000
586	48	Requirements Decomposition Analysis	$ 125,000
		Johnson Space Center	**$ 8,000**
588	115	Software Productivity Consortium	$ 8,000
		Total:	**$ 3,434,079**

Appendix A: Acronyms

Acronym	Expansion / Definition
ASSET	Advanced Systems and Software Engineering Technologies
CI	Center Initiative
CIM	Center Initiative Management (tool)
CSIP	Center Software Initiative Proposal (CI proposal)
DPM	Delegated Program Manager
GRC	Glenn Research Center
GSFC	Goddard Space Flight Center
ISO	International Organization for Standardization
IV&V	Independent Verification and Validation
NRA	NASA Research Announcement
OSMA	Office of Safety and Mission Assurance
PV	Process Verification
SWG	Software Working Group
S&MA	Safety and Mission Assurance
UI	University Initiative
URL	Uniform Resource Locator
USIP	University Software Initiative Proposal
WVU	West Virginia University